

Table 07 Fixed Resistor Screening Requirements (Page 1 of 2)

Inspection/Test	Test Methods, Conditions and Requirements (Note 1)	Notes	Part Type/Grade Level					
			Composition		Film		Wirewound	
			1	2	1	2	1	2
Precap Visual Inspection	<u>Networks</u> Particles, metallization (scratches, voids, adherence, bridging, alignment, corrosion, probe marks), laser trim faults, bonding pad defects, oxide defects <u>Others</u> : Not applicable	2, 3			X			
Visual Inspections	Materials, design, construction, marking, and workmanship	4	X	X	X	X	X	X
Mechanical Inspections	Critical physical dimensions	5	X	X	X	X	X	X
Initial dc Resistance	MIL-STD-202, Method 303	6, 7, 8	X	X	X	X	X	X
Thermal Shock	MIL-STD-202, Method 107 Grade 1 - 25 cycles Grade 2 - 10 cycles High temperature - max. rated operating Low temperature - min. rated operating	9, 10			X	X		
Power Conditioning	MIL-STD-202, Method 108 Specified rated wattage multiple Specified temperature Specified time If time ≤ 24 hours: continuous operation If time > 24 hours: 1.5 hours on, 0.5 hours off	9, 10 11, 12			X	X	X	X
Final dc Resistance	MIL-STD-202, Method 303 Resistance and ΔR to specification				X	X		

See notes on page C-24.

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Inspection/Test	Test Methods, Conditions and Requirements (Note 1)	Notes	Part Type/Grade Level					
			Composition		Film		Wirewound	
			1	2	1	2	1	2
Hermetic Seal	Fine leak: MIL-STD-202, Method 112 Test Condition C 5.0 X 10 ⁻⁷ cc/sec. (networks) 1.0 X 10 ⁻⁸ cc/sec. (others) Gross Leak: MIL-STD-883, Method 1014 Condition D	13			X	X		
Radiographic Inspection	MSFC-STD-355C	14			X		X	
Percent Defective Allowable (PDA)	Grade 1 - 5% Grade 2 - 10%	15	X	X	X	X	X	X

Notes:

1. It is the responsibility of the user to specify the test conditions and define the pass/fail criteria for each inspection. These values shall be based on the nearest equivalent military specification, the manufacturer's specification, or the application, whichever is most severe.
2. Examination shall be performed using binocular magnification of 50X to 100X.
3. If solder is used for internal connections, it shall have a liquid point not less than +280°C.
4. Small resistors, such as chip resistors, shall be examined using 30X to 60X magnification, but in case of conflict, 30X shall be the referee power.
5. A minimum of 3 resistors shall be measured. In the event of a failure, the entire lot shall be screened for dimensions and rejects discarded.
6. The test voltage must be specified in the SCD or by the manufacturer (commercial parts).
7. For networks, unless otherwise specified, individual resistive elements shall be isolated (whenever possible) to minimize computation of pin-to-pin resistance values.
8. Out of tolerance composition resistors shall be baked in accordance with the SCD or manufacturer's instructions and then remeasured. Resistors that remain out of tolerance after baking shall be considered failures.
9. ΔR is optional after this inspection if ΔR is specified for thermal shock and conditioning combined.
10. External visual examination required after testing to verify no evidence of mechanical damage.
11. Not applicable to chip resistors. Conditioning time for film networks with internal solder terminations shall be 250 hours minimum.
12. Unless otherwise specified, the manufacturer's maximum rated continuous dc working voltage should not be exceeded during conditioning as determined by $V = \sqrt{PR}$.
13. Applicable only to hermetically sealed networks and high stability film resistors.
14. Not applicable to composition, chip or network resistors.
15. Marking and cosmetic defects shall not be counted for purposes of establishing the defect rate for PDA.

Table 07A Variable Resistor Screening Requirements (Page 1 of 3)

Inspection/Test	Test Methods, Conditions and Requirements (Note 1)	Notes	Part Type/Grade Level			
			Non-Wirewound		Wirewound	
			1	2	1	2
Visual Inspections	Materials, design, construction, marking, and workmanship		X	X	X	X
Mechanical Inspections	Critical physical dimensions	2	X	X	X	X
Thermal Shock	MIL-STD-202, Method 107 Grade 1 - 25 cycles Grade 2 - 10 cycles High temperature - max. rated operating Low temperature - min. rated operating Total resistance and ΔR to specification Setting stability ($\Delta\%$) to specification Continuity check	3, 4, 5, 6	X	X	X	X
Conditioning	MIL-STD-202, Method 108 Specified rated wattage multiple Specified temperature 100 hours minimum (Grade 1), 1.5 hours on, 0.5 hours off 50 hours minimum (Grade 2), 1.5 hours on, 0.5 hours off Total resistance and ΔR to specification	3, 4, 7	X	X	X	X
Contact Resistance Variation or Peak Noise	Contact resistance variation to specification, or Peak noise (resistance variation) to specification	8	X	X	X	X
Immersion	Gross leak: MIL-STD-202, Method 112, Test Condition D Modify as follows: 1. Precondition resistors at +125°C for 15±2 minutes. 2. Stabilize at room temperature for 15±2 minutes. 3. Immerse into fluorocarbon bath held at +85°C to +90°C, shake for 5 seconds maximum, then keep resistors submerged for a period of 1 minute ±5 seconds. 4. Discard resistors with inadequate seals as evidenced by a continuous stream of bubbles emanating from any concentrated point on the resistor.		X	X	X	X

See notes on page C-26.

Table 07A Variable Resistor Screening Requirements (Page 2 of 3)

Inspection/Test	Test Methods, Conditions and Requirements (Note 1)	Notes	Part Type/Grade Level			
			Non-Wirewound		Wirewound	
			1	2	1	2
Actual Effective Electrical Travel	Number of turns or angular degrees to specification	9	X		X	
Absolute Minimum Resistance	Resistance to specification	10			X	X
End Resistance	Resistance to specification	11	X	X	X	X
DWV	MIL-STD-202, Method 301 Specified test voltage Between terminals tied together and all external metal portions Leakage current to specification	3	X		X	
IR	MIL-STD-202, Method 302, Test Condition A or B Between terminals tied together and all external metal portions Resistance (minimum) to specification		X		X	
Torque	Operating torque to specification Clutch to specification (when applicable) Stop strength to specification (when applicable)	12, 13, 14	X	X	X	X
Radiographic Inspection	MIL-STD-202, Method 209	15	X		X	
Percent Defective Allowable (PDA)	Grade 1 - 5% Grade 2 - 10%	16	X	X	X	X

Notes:

1. It is the responsibility of the user to specify the test conditions and define the pass/fail criteria for each inspection. These values shall be based on the nearest equivalent military specification, the manufacturer's specification, or the application, whichever is most severe.
2. A minimum of 3 resistors shall be measured. In the event of a failure, the entire lot shall be screened for dimensions and rejects discarded.
3. External visual examination required after testing to verify no evidence of mechanical damage.
4. Total resistance shall be measured between the end terminals with the movable contact arm positioned against a stop. The positioning of the contact arm and terminal shall be the same for all subsequent measurements of total resistance on the same specimen. The test voltage for total resistance measurements must be specified in the SCD or by the manufacturer (commercial parts).
5. Setting stability in percent shall be determined by placing the movable contact arm at approximately 40% of the actual effective electrical travel. A dc test potential shall be applied between the end terminals. The measured voltage between the contact arm and one end terminal (E1) and the measured voltage between the end terminals (E2) shall be used to determine the setting stability in percent using the following formula:

$$\text{Setting stability (\%)} = (E1 \times 100)/E2.$$

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Notes (Continued):

6. There shall be no abrupt discontinuities, especially when the direction of travel is reversed, as the contact arm is rotated at a uniform rate back and forth two times across the actual effective electrical travel. During rotation, a suitable electrical device shall be connected between the contact arm and either end terminal to monitor the change in resistance or voltage.
7. The conditioning voltage shall be applied between the end terminals. Unless otherwise specified, the manufacturer's rated continuous dc working voltage should not be exceeded during conditioning as determined by $V \neq PR$.
8. Contact resistance variation or peak noise is a measure of any spurious variations in the electrical output as the contact arm is rotated. It is expressed either as a maximum resistance variation limit, or as a percentage of the total resistance output for the specified rotational travel increment. The output can be observed on an oscilloscope or strip chart recorder, and either method requires calibration to obtain a measure of the peak resistance spikes observed during contact arm rotation. The contact arm shall be rotated in both directions through 90 percent of the actual effective electrical travel for a total of 6 cycles. Only the last 3 cycles shall count in determining whether or not a spurious resistance variation is observed at least twice in the same location, exclusive of the roll-on or roll-off points where the contact arm moves between the termination and resistance element.
9. The actual effective electrical travel shall be measured by placing the resistor in a suitable device and circuit which will indicate both angular position of the operating shaft and electrical output. The actual effective electrical travel will be the number of turns, or degrees of rotation, in which a change in contact arm position gives a measurable change in electrical output.
10. The contact arm shall be positioned at the extreme counterclockwise limit of mechanical travel, and the resistance shall be measured between the contact arm and corresponding end terminal. Caution: do not exceed rated current during this measurement.
11. The contact arm shall be so positioned at one end of the resistance element so that a minimum value of resistance can be determined. The same procedure shall be followed for the other end of the resistance element. Caution: do not exceed rated current during this measurement.
12. The torque required to move the contact arm on the resistance element shall be determined at approximately 10, 50, and 90 percent of actual effective electrical travel by the torque wrench method or any suitable equivalent.
13. If the resistor contains a clutch mechanism, the contact arm shall be adjusted to each extreme limit of mechanical travel, and sufficient torque shall be applied to the actuator to permit the contact arm to idle for 25 complete mechanical turns. During idle, a suitable electrical indicating device connected between the contact arm terminal and an adjacent end terminal shall be observed for electrical continuity. After idle, the contact arm shall be rotated in the opposite direction, and the indicating device shall be observed to determine whether the contact arm actually reversed direction.
14. When stop strength is specified, the contact arm shall be rotated to each extreme of mechanical rotation with the specified torque applied through the operating shaft to the stop.
15. The SCD must detail the complete procedure for examining resistors for internal defects, such as contact arm misalignment, resistive element flaws, particles, etc., via radiographic inspection.
16. Marking or cosmetic defects shall not be counted for purposes of establishing the defect rate for PDA.